

EXPANSION-NOZZLE CRYOGENIC REFRIGERATION SYSTEM
WITH RECIPROCATING COMPRESSOR

ABSTRACT OF THE DISCLOSURE

5 A cryogenic refrigeration system includes an expansion nozzle having a high-pressure nozzle inlet and a low-pressure nozzle outlet, and a compressor having a compression device, such as a pair of opposing pistons, operable to compress gas within a compression volume. The compression volume has an inlet port and an outlet port. A flapper inlet valve has an inlet valve inlet, and an inlet valve outlet in gaseous communication with the inlet port of the compression
10 volume. The inlet valve opens when a gaseous pressure at the inlet valve inlet is sufficiently greater than a gaseous pressure in the compression volume to overcome a spring force of the flapper inlet valve. A flapper outlet valve has an outlet valve inlet in gaseous communication with the outlet port of the compression volume, and an outlet valve outlet in gaseous communication with
15 the nozzle inlet. The outlet valve opens when a gaseous pressure in the compression volume is greater than a gaseous pressure at the outlet valve outlet to overcome a spring force of the flapper outlet valve. A drive motor system is in driving mechanical communication with the compression pistons. The compression volume is hermetically isolated from the drive motor system.